

76. The graph of a function f is shown above. Which of the following statements about f is false?

- (A) f is continuous at $x = a$. F
 (B) f has a relative maximum at $x = a$. T
 (C) $x = a$ is in the domain of f . T
 (D) $\lim_{x \rightarrow a^+} f(x)$ is equal to $\lim_{x \rightarrow a^-} f(x)$. T
 (E) $\lim_{x \rightarrow a} f(x)$ exists. T

78. The radius of a circle is decreasing at a constant rate of 0.1 centimeter per second. In terms of the circumference C , what is the rate of change of the area of the circle, in square centimeters per second?

(A) $-(0.2)\pi C$

(B) $-(0.1)C$

(C) $-\frac{(0.1)C}{2\pi}$

(D) $(0.1)^2 C$

(E) $(0.1)^2 \pi C$

$$\frac{dr}{dt} = -0.1 \frac{\text{cm}}{\text{sec}}$$

$$C = 2\pi r \rightarrow r = \frac{C}{2\pi}$$

$$\frac{dC}{dt} = 2\pi \frac{dr}{dt}$$

$$\frac{dC}{dt} = -0.2\pi \frac{\text{cm}}{\text{sec.}}$$

$$A = \pi \left(\frac{C}{2\pi} \right)^2$$

$$A = \frac{C^2}{4\pi}$$

$$\frac{dA}{dt} = \frac{2C}{4\pi} \frac{dC}{dt}$$

$$\frac{dA}{dt} = \frac{-0.2\pi C}{2\pi} \rightarrow = -0.1C$$

81. Let f be the function given by $f(x) = |x|$. Which of the following statements about f are true?

- I. f is continuous at $x = 0$. T
 II. f is differentiable at $x = 0$. F
 III. f has an absolute minimum at $x = 0$. T

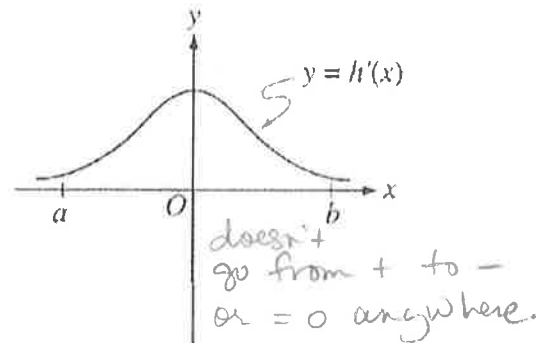
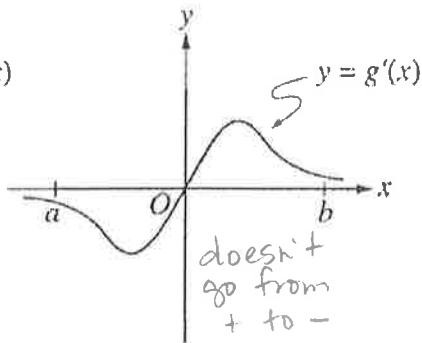
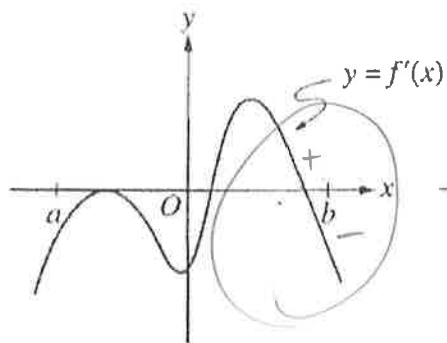
(A) I only

(B) II only

(C) III only

(D) I and III only

(E) II and III only



79. The graphs of the derivatives of the functions f , g , and h are shown above. Which of the functions f , g , or h have a relative maximum on the open interval $a < x < b$?

- (A) f only
(B) g only
(C) h only
(D) f and g only
(E) f , g , and h

Max where derivative is zero and goes from + to -

83. If $a \neq 0$, then $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x^4 - a^4}$ is

$$\frac{(x+a)(x-a)}{(x^2+a^2)(x^2-a^2)}$$

$$\lim_{x \rightarrow a} \frac{1}{x^2+a^2} = \frac{1}{2a^2}$$

(A) $\frac{1}{a^2}$

(B) $\frac{1}{2a^2}$

(C) $\frac{1}{6a^2}$

(D) 0

(E) nonexistent

87. Which of the following is an equation of the line tangent to the graph of $f(x) = x^4 + 2x^2$ at the point where $f'(x) = 1$?

$$f(x) = x^2(x^2 + 2)$$

$$m = 4x^3 + 4x$$

$$1 = 4x^3 + 4x$$

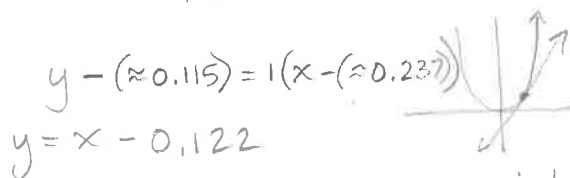
$$0 = 4x^3 + 4x - 1$$

use grapher to solve

$$x \approx 0.237$$

$$f(\approx 0.237) \approx 0.115$$

- (A) $y = 8x - 5$
(B) $y = x + 7$
(C) $y = x + 0.763$
(D) $y = x - 0.122$
(E) $y = x - 2.146$



$$y - (\approx 0.115) = 1(x - (\approx 0.237))$$

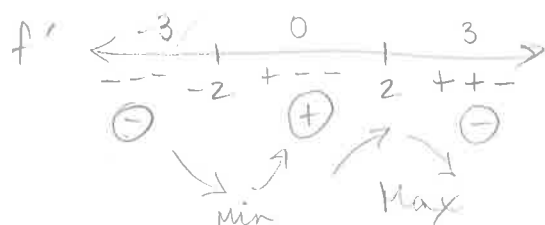
$$y = x - 0.122$$

point of tangency

89. If g is a differentiable function such that $g(x) < 0$ for all real numbers x and if $f'(x) = (x^2 - 4)g(x)$, which of the following is true?

$$(x+2)(x-2)(-)$$

- (A) f has a relative maximum at $x = -2$ and a relative minimum at $x = 2$.
(B) f has a relative minimum at $x = -2$ and a relative maximum at $x = 2$.
(C) f has relative minima at $x = -2$ and at $x = 2$.
(D) f has relative maxima at $x = -2$ and at $x = 2$.
(E) It cannot be determined if f has any relative extrema.



Min @ $x = -2$

Max @ $x = 2$

90. If the base b of a triangle is increasing at a rate of 3 inches per minute while its height h is decreasing at a rate of 3 inches per minute, which of the following must be true about the area A of the triangle?

$$\frac{db}{dt} = 3 \frac{\text{in}}{\text{min}}$$

$$\frac{dh}{dt} = -3 \frac{\text{in}}{\text{min}}$$



$$A = \left(\frac{1}{2}b\right)(h)$$

$$\frac{dA}{dt} = \frac{1}{2}b \frac{dh}{dt} + \frac{1}{2} \frac{db}{dt} h$$

$$\frac{dA}{dt} = \frac{1}{2}[b(-3) + 3h]$$

$$\frac{dA}{dt} = \frac{3}{2}(h - b)$$

- (A) A is always increasing.
 (B) A is always decreasing.
 (C) A is decreasing only when $b < h$.
 (D) A is decreasing only when $b > h$.
 (E) A remains constant.

91. Let f be a function that is differentiable on the open interval $(1, 10)$. If $f(2) = -5$, $f(5) = 5$, and $f(9) = -5$, which of the following must be true?

- I. f has at least 2 zeros. T
 II. The graph of f has at least one horizontal tangent. T
 III. For some c , $2 < c < 5$, $f(c) = 3$. T

increasing
when $h > b$
decreasing
when $b > h$

- (A) None
 (B) I only
 (C) I and II only
 (D) I and III only
 (E) I, II and III

